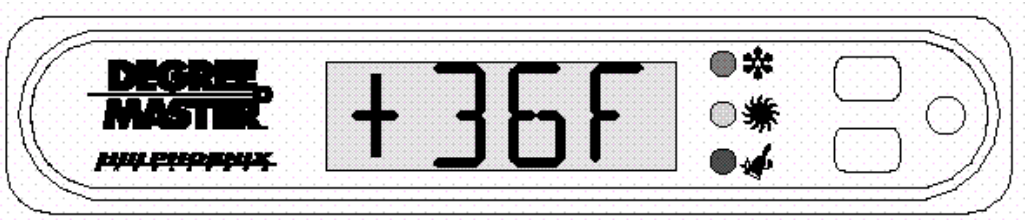
Refrigeration and Air Conditioning Controls

User's manual

Degree Master Controller in AKC 55 Systems



ADAP-KOOL®

REFRIGERATION AND AIR CONDITIONING

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Introduction

The Degree Master is a Hill PHOENIX stand-alone controller for refrigerated cases and boxes in supermarkets. In addition to stand-alone operation, Degree Masters can function as nodes in the input-output network of an AKC 55 supermarket control and monitoring system. The Degree Master is powered by the fixture in which it is installed by the case manufacturer. In addition to the load center and an on-case display, the installation may include outboard add-on modules for defrost and anti-sweat heaters.

Outputs

The Degree Master Load Center can support three kinds of outputs:

(1) one solenoid valve or compressor;
(2) lights;
(3) fans or defrost.

Inputs

There can be up to five sensor inputs.

Display and wireless remote

The Degree Master has a local display that shows sensor values and settings and that can be used to program some functions. A user can fully interrogate and program the unit using its wireless handheld remote control. When used in an AKC 55 system, the Degree Master can be completely configured, and all settings and values observed, at the AKC 55 display or on a connected PC.

Echelon® communications

The Degree Master, like other devices on an AKC 55's IO network, is Echelon® compatible. Because the Degree Master is an FTT device, an FTT to TP78 bridge is needed when connecting it to an AKC 55 IO network.

Further information

The remainder of this manual deals with configuration and use of the Degree Master in an AKC 55 supermarket control and monitoring system.

For complete information about Degree Master display and handheld functions, refer to the Degree Master handbook supplied by Hill PHOENIX.

Configuring the host AKC 55 for Degree Master

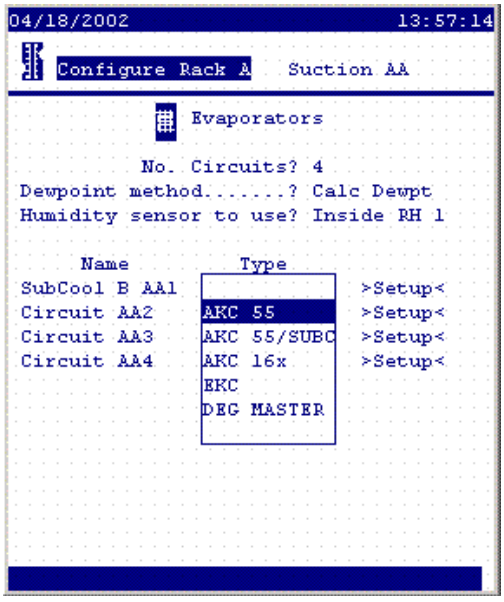
[**Note:** In the remainder of this manual, some familiarity with the AKC 55, particularly with navigation, is assumed. For a refresher, refer to Chapter 4 (introduction) and the first part of section 4-1, and the introduction and section 5-1 of the AKC 55 System User's Manual. Those portions of the manual contain information on navigation and making changes both at the AKC 55 keypad and display or at your PC. The following instructions assume that you are doing the configuration from a PC.] The manual is available electronically from the literature library at www.danfoss.com.]

Locate and Init will be needed

After initial configuration, a Degree Master needs to be put through the Locate process, described at the end of this section on page 16. The Locate process only needs to be done once when a Degree Master is connected to the system

After any change in configuration, whether in the configuration screens or the settings screens, the Init procedure must be used before the changes will take effect. The procedure is described at the end of this section on page 16.

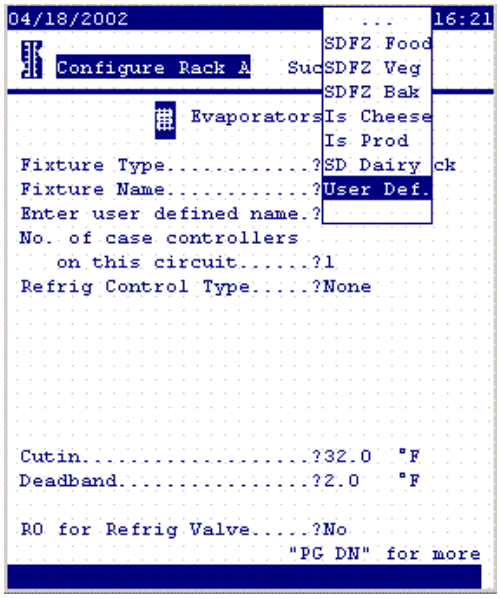
To begin configuration of a circuit with Degree Master controllers, select **Evaporators** from the Configure Rack menu, then increment the number of circuits. Next, under Type for the new circuit, left click on the field contents (by default "AKC 55") , and a selection box appears:



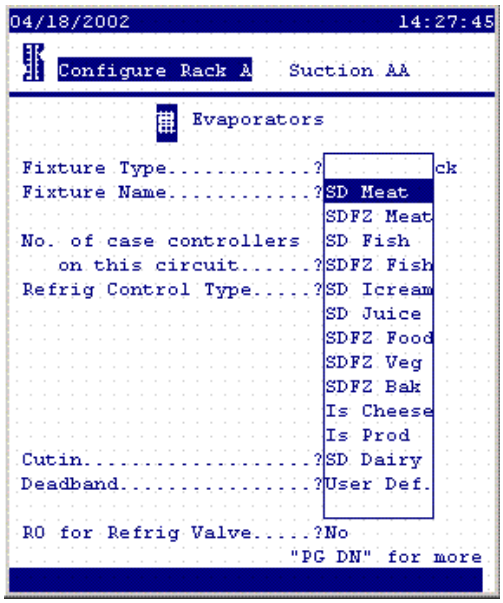
With the selection box open, click on DEG MASTER and right click or press ENTER. Then click on >Setup< in the rightmost column for your new circuit. You can subsequently change the configuration of the circuit by using >Setup<.

Setting up a circuit

When the circuit setup screen appears, choose the type of case. Let's assume that we are configuring a single deck meat case, so for fixture type we select "single deck. For the second line, "fixture name," we want to select "meat case," but all we see in the selection box is this:



Notice that there are three dots at the top of the selection box. click on the dots and the rest of the selections appear:

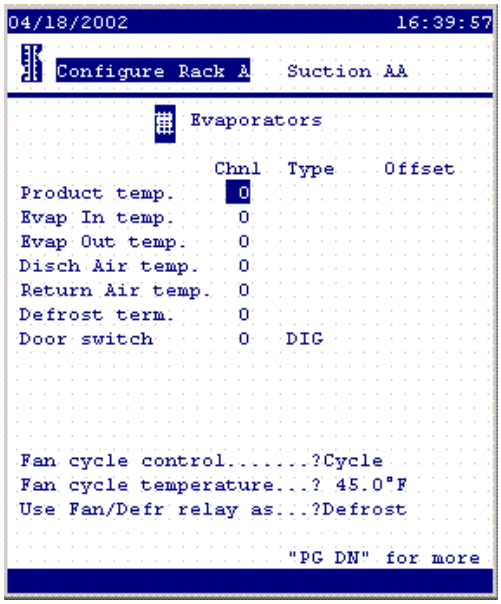


Now we can click on the name “SD Meat.” The rest of the circuit identification, the rack and suction group number, will be automatically appended.

Now proceed through the screen and answer the questions. The questions and the meanings of the choices follow for the remaining configuration pages.

Number of case controllers on this circuit?	(0 to 15) Enter the number of Degree Masters on the circuit.	
Refrig Control Type?	NONE	No case control.
	CYCLE	Degree Master is controlling a solenoid valve.
Valve open when relay?	[appears only if CYCLE is selected for the previous question]	
	Energized OFF	- for normally closed valves
	Energized ON	- for nomally open valves
Cut in?	The discharge air temperature at which the controller will open the valve.	
Dead band?	The number of degrees below cut-in at which the valve will be closed.	
Line-up Temp Control?	Average Temp	Control will be based on the average of the discharge air temperature sensors in the lineup.
	Max Temp	Control will be based on the maximum discharge air temperature in the lineup.
	Min Temp	Control will be based on the minimum discharge air temperature in the lineup.
RO for Refrig Valve?	(Yes, No) A relay output is created for each Degree Master on the circuit. Answer Yes to the question when the refrigeration solenoid valve is at the rack rather than at the fixture.	

The second page of configuration looks like this:



The Degree Master has five channels for universal analog inputs. Not all sensors need be present. The case manufacturer usually supplies a list of the sensors installed and their channels. A given sensor channel can serve more than one purpose; for example, a discharge air temperature sensor can also serve as defrost termination sensor. In that case, the same channel number would be entered opposite both names.

Sensor types are as follows:

TP1	A temperature sensor, part no. C26001000
TP2	A temperature sensor, part no. 084N3016
DIG	The input is from dry contacts such as for a door or for a defrost termination thermostat.
Elm	A BAT product temperature sensor made by Elm Controls

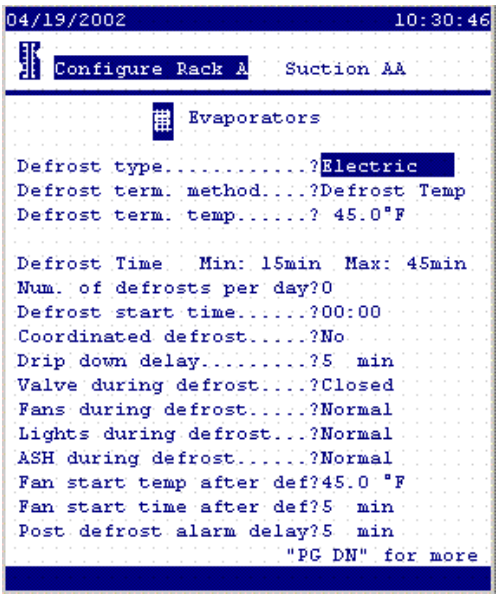
Fan cycle control?	Cycle	Fans will cycle on Evap Out temperature.
	Normal	Fixture fans will not cycle.
Fan cycle temperature?		(-99.9° to 99.9°(Appears only when Cycle is selected for the previous question) When Evap Out temperature is greater than Fan cycle temperatuare, fans will be turned off.
Use Fan/Defr relay as?	Fans	The Fan/Defrost relay will operate on fan logic.
	Defrost	The Fan/Defrost. relay will operate on defrost logic.

Page down for the next screen of settings:

`

Defrost configuration

This screen contains all defrost configuration questions.



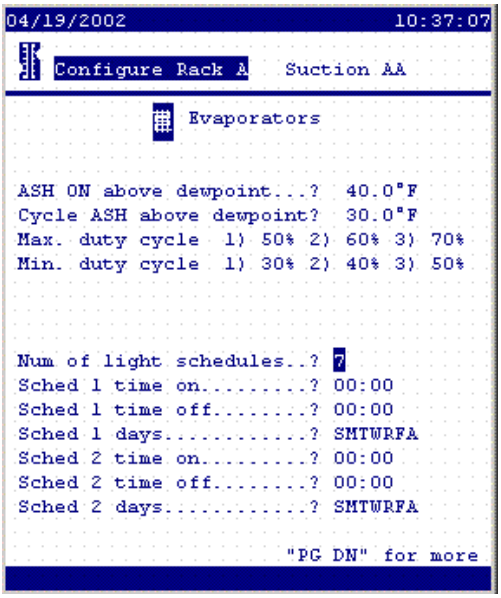
The questions, and their possible answers, are as follows:

Defrost type?	None	No defrost is controlled.
	Electric	The circuit has electric defrost.
	Hot Gas	The circuit has hot gas defrost.
	Warm Liq	The circuit has warm liquid defrost.
	Reverse Air	The circuit has reverse air defrost.
	Passive	The circuit has time off defrost.
Defrost term. method?	Time	Defrost will terminate when the maximum defrost time has been reached.
	Defrost Temp	Defrost will terminate when the defrost temperature sensor reaches a value set in the next answer unless the maximum defrost time is reached at a lower temperature. Time settings have priority. If the fixture reaches termination temperature before minimum time has expired, the defrost still must complete minimum time. If termination temperature has not been reached before maximum time has expired, the defrost will terminate on time.]
	Contact Closed	Termination depends on closure of a defrost termination thermostat.
	Contact Open	Termination depends on opening of a defrost termination thermostat.

Defrost term. temp?		(-99.9 to 99.9) (appears only when Defrost Temp is selected as the termination method)
Defrost Time	Min	(0-120 minutes) The minimum time for each defrost.
	Max	(0-120 minutes) The maximum time for each defrost.
Num. of defrosts per day?		The number of defrosts that will be initiated per day, from 0 to 24. The first defrost will initiate at the time specified in the next answer. Remaining defrosts will be at equally spaced intervals during the hours remaining after the first defrost until midnight each day.
Defrost start time?		The time for the first defrost to begin.
Coordinated defrost?		When multiple Degree Masters are operating on a circuit, they will defrost at the same time. Refrigeration will not resume for any fixture until all have finished defrosting.
Drip down delay?		(0-999 minutes)The number of minutes that refrigeration will remain off after defrost termination to allow for liquid to drain from the evaporator..
Valve during defrost?		(Closed, Open) The state of the refrigeration solenoid valve during defrost
Fans during defrost?		(Normal, Off) The state of controlled fixture's fans during defrost.
Lights during defrost?		(Normal, Off) The state of controlled fixture lights during defrost.
ASH during defrost?		(Normal, Off) The state of controlled anti-sweat heaters during defrost.

Fan start temp after def?	(-99.9° to 99.9°) The defrost termination temperature sensor temperature at which the controlled fixture's fans will begin to operate after defrost termination.
Fan start time after def?	(0-999 minutes) The maximum time that will elapse after defrost before fans start, regardless of temperature.
Post defrost alarm delay?	(0-999 minutes) The time that must elapse before fixture alarms will begin operating after termination of defrost. Alarm counters will remain at zero until this time elapses.

Page down to the next screen:


04/19/2002 10:37:07
Configure Rack A Suction AA
Evaporators
ASH ON above dewpoint...? 40.0°F
Cycle ASH above dewpoint? 30.0°F
Max. duty cycle 1) 50% 2) 60% 3) 70%
Min. duty cycle 1) 30% 2) 40% 3) 50%
Num of light schedules..? 2
Sched 1 time on.....? 00:00
Sched 1 time off.....? 00:00
Sched 1 days.....? SMTWRFA
Sched 2 time on.....? 00:00
Sched 2 time off.....? 00:00
Sched 2 days.....? SMTWRFA
"PG DN" for more

Anti-sweat heaters

ASH ON above dew point?

(-100° to +100°) The dew point above which anti-sweat heaters will be on constantly.

Cycle ASH above dewpoint?

(-100° to +100°) The dew point above which anti-sweat heaters will cycle.

Max. duty cycle?

(0 to 100%) The maximum percentage of any 7 second cycle that anti-sweat heaters will operate.

Min. duty cycle?

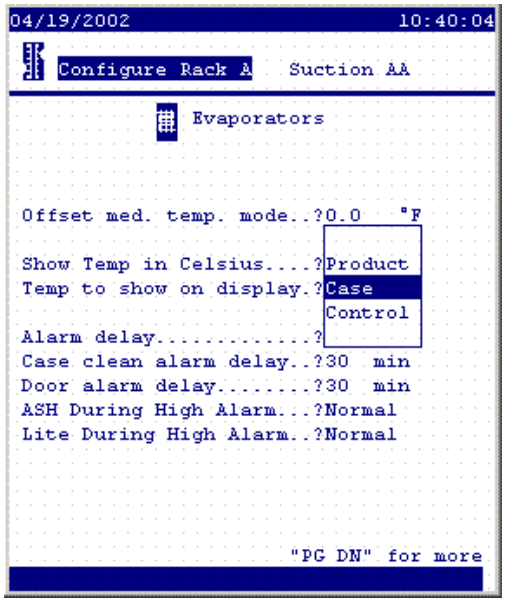
(0 to 100%) The minimum percentage of any 7 second cycle that anti-sweat heaters will operate.

Lighting schedules

Num of light schedules?

(0-7) The number of lighting schedules that will be entered for the fixture lights. For an explanation of schedule entries, see Chapter 4 section 4 of the AKC 55 System User Manual.

Page down to the next screen:



Offset med. temp. mode?		(-40° to +40°) The offset by which temperature target setpoint and alarm limits will be raised for operation in the medium temperature range in dual temperature operation.
Show Temp in Celsius?	Yes	Temperatures will be shown in degrees Celsius.
	No	Temperatures will be shown in degrees Fahrenheit.
Temp to show on display?	Product	The display will show the value of a product sensor.
	Case	The diplay will show the discharge air temperature.
	Control	The display will show the control temperature, whether lineup average, minimum, or maximum (depending on answer to earlier configuration question.
Alarm delay?		(0-999 minutes) This is the general time limit for the four sensor alarms described in the next screen. It is not returned to the factory default (30 minutes) when sensor alarms are deleted. (See discussion about the next screen).
Case clean alarm delay?		(0-999 minutes) The number of minutes that alarms will be sus-

pended when case cleaning is initiated with the remote control or in the service screen.

Door alarm delay? (0-999 minutes) The number of minutes a door can remain open before an alarm is generated.

ASH During High Alarm? (On, Off) State of anti-sweat heaters during high temperature alarm conditions.

Lite During High Alarm? (On, Off) State of lights during high temperature alarm conditions.

Alarms

Before we discuss the next screen, reached by paging down, it will be useful to review the various alarm levels that can be assigned to any alarm in an AKC 55 system.

Alarm actions and trip levels

There are four alarm levels that appear in the selection box in the center:

Disabled The alarm settings remain configured but alarms will not be generated. Alarms can be reactivated with settings previously configured by selecting Log Only, Normal, or Critical.

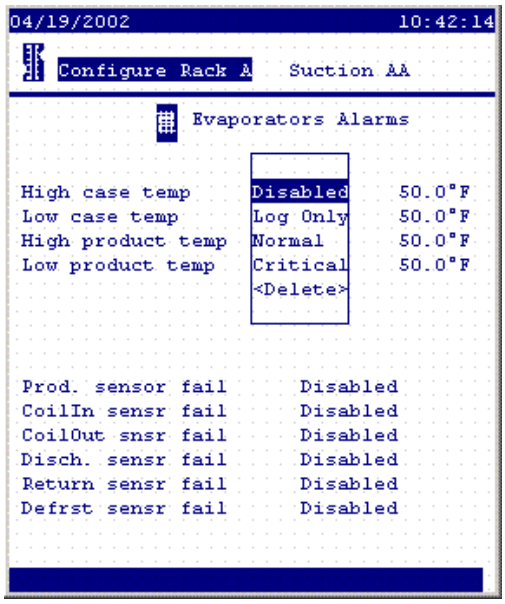
Log Only Alarms will be logged, but will not be routed to local or remote locations (as specified in the alarm routing screen).

Normal Alarms will be generated once and routed to all active locations specified in the alarm routing screen.

Critical Alarms will be generated and routed to all active locations specified in the alarm routing screen. Once a critical alarm trips, it will be sent out repeatedly to active locations at the interval specified for critical alarms in its AKC 55 until either clear or acknowledged. An alarm is clear when its sensor value returns to a non-alarm level.

<Delete> The alarm is disabled and the setting (in this case the temperature level only) returned to the factory default (50°)The next screen, which we reach by paging down, concerns alarms.

Now page down to the next screen:


04/19/2002 10:42:14
Configure Rack A Suction AA
Evaporators Alarms
High case temp Disabled 50.0°F
Low case temp Log Only 50.0°F
High product temp Normal 50.0°F
Low product temp Critical 50.0°F
<Delete>
Prod. sensor fail Disabled
CoilIn sensr fail Disabled
CoilOut snsr fail Disabled
Disch. sensr fail Disabled
Return sensr fail Disabled
Defrst sensr fail Disabled

Alarm types

The upper portion of the screen lists the types of standard alarms that can be generated by a Degree Master. Each can have a trip level from -999.9° to +999.9°. If the <delete> option is used, the value will be returned to the factory default, 50°.

Sensor failure alarms

A Degree Master can support up to six sensors, each with an associated failure alarm. A failed sensor is one that is shorted or an open circuit, reading 127°or -40° respectively. The same delay (set in the previous screen) applies to sensor failure alarms that applies to other alarms.

The Degree Master sensors are installed by the case manufacturer. Their usual locations are:

Product sensor	Placed in the product area of the fixture.
CoilIn sensor	At the evaporator coil inlet.
CoilOut sensor	At the evaporator coil outlet.
Discharge sensor	In the primary discharge air stream
Return sensor	In the return air stream.
Defrost sensor	Usually on the evaporator coil; but sometimes a single sensor is used for both defrost and discharge air temperatures.

Locate Procedure

When a new Degree Master is added to the AKC 55 system, or when there has been a service replacement, you must use the “Locate Procedure” so that the AKC 55 will recognize the Degree Master.

From the Main Menu, select Refrigeration, then select the rack, then Configure Rack, and Board & Points. Select the rightmost icon at the bottom of the screen, which represents Other Controllers. When the menu appears, select DEG MASTER. This is the screen that appears:

05/16/2002 11:03:05
Configure Rack A DEG MASTER
Deg Master Controls
Wink All Degree Master
Name Addr
SD Meat AA2a 0 Locate Init Upload
SD Meat AA2b 0 Locate Init Upload

Follow this procedure:

1) Enter an address from 1 to 99 that is unique among the Degree Masters in the system.
2) Select Locate and press ENTER or click with your mouse.
3) A message will appear requesting that you press the service pin.
4) You have 10 minutes to go to the particular Degree Master you are working with and depress the service pin. The service pin (or button) is located beneath the upper right corner of the square white label on the Degree Master.
5) Use a pencil (or other instrument that will fit through the access hole) to depress the service button and keep it depressed for five seconds.

It will take the AKC 55 from 10 to 15 seconds to complete the location process, after which a message box will appear on the AKC 55 telling you that the process has been successful. This process must be repeated for each new or replacement Degree Master.

Activating the service pin from the display

After starting the locate procedure from the AKC 55 keypad, it is possible to activate the service pin from the Degree Master's display. Press and hold both buttons for 3 seconds. When the Degree Master enters the service mode, the display will change to "RS" with an up arrow on the left and a down arrow on the left. Pressing the lower button will now activate the service pin. The down arrow will change to an asterisk as confirmation. Be careful not to press the upper button. Doing so will reset the Degree Master.

Initialization

After the Locate procedure, Select Init and press ENTER or click with your mouse. The initialization procedure will take about 10-15 seconds.

Wink

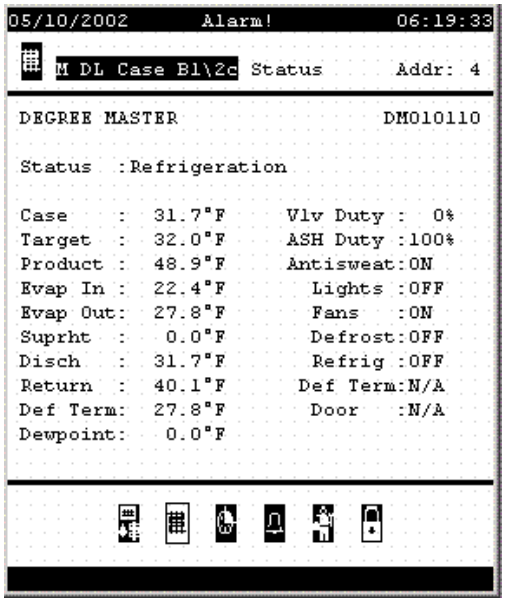
"Wink All Degree Master" is a toggle (first ENTER turns on, second turns OFF) that will cause all the Degree Masters on the network to flash their node numbers repeatedly. If a unit does not wink its number, test its function with the handheld remote control. If the unit is functioning to control the fixture, troubleshoot its network connection and addressing.

Using the Degree Master in an AKC 55 System

[**Note:** In the remainder of this manual, some familiarity with the AKC 55, particularly with navigation, is assumed. For a refresher, refer tto Chapter 4 (introduction) and the first part of chapter 4-1, and the introduction and section 5-1 of chapter 5 of the AKC 55 System User's Manual. Those portions of the manual contain information on navigation and making changes both at the AKC 55 keypad and display or at your PC. The following instructions assume that you are doing the configuration from a PC.[The manual is available electronically from the literature library at www.danfoss.com.]

Degree Master status screen

From the AKC 55 Main Menu, select Refrigeration, then the rack, then Evaporators, and finally the Degree Master circuit you want to work with. The screen that appears contains current information about the Degree Master's status:



Software version

At the top right of the main body of the screen is the version of software running in the Degree Master, in the illustrated screen, version DM010110.

In the main body of the screen, the meanings of the fields and their contents are as follows. All possible sensors are listed; only those configured will have readings. Unconfigured sensors will have an asterisk in the value field.

Status: The field gives the current operating state of the fixture:

- **Refrigeration** The fixture is operating with its current Degree Master settings.
- **Defrosting** Defrost is underway. Refrigeration is off.
- **Drip Down** Defrost has terminated. Refrigeration is off pending completion of the drip down period configured.

Status (cont'd)

Fan Delay Defrost has terminated. Refrigeration is on. Fans are off pending completion of the fan delay time.

Case Cleaning The fixture is shut down for cleaning.

Case Off The fixture has been turned off by means of the service screen.

Case: The temperature of the sensor being used for control, as selected during configuration.

Target: The target temperature set during configuration.

Product: Product sensor temperature.

Evap In: Evaporator inlet sensor temperature.

Evap Out: Evaporator outlet sensor temperature.

Suprht: Calculated superheat.

Disch: Discharge air sensor temperature.

Return: Return air sensor temperature.

Def Term: Dedfrost termination sensor temperature.

Dewpoint: Dewpoint as calculated by the AKC 55.

Vlv Duty: Current valve duty percentage calculated by the Degree Master.

ASH Duty: Current ASH duty percentage calculated by Degree Master.

Antisweat: (On, Off) State of anti-sweat heaters.

Lights: (On, Off) State of fixture lights.

Fans: (On, Off) State of fixture fans.

Defrost: (On, Off) Stateof fixture defrost.

Refrig: (On, Off) State of refrigeration in

the fixture.

Def Term: (On, Off) State of defrost termination thermostat.

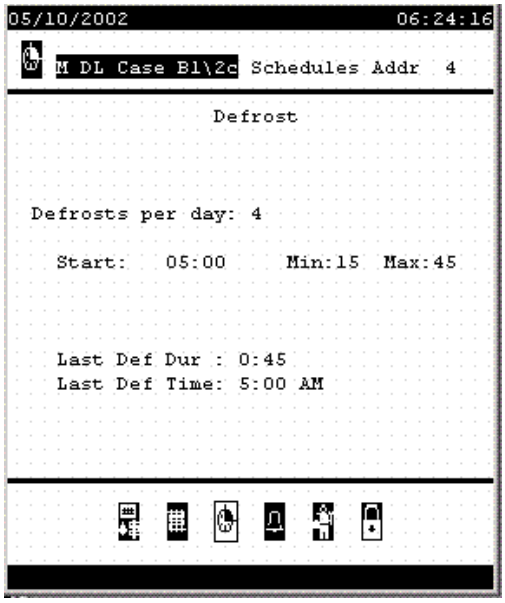
Door: (Open, Closed) State of door switch.

Navigational Icons

There are six navigational icons at the bottom of the screen. The main evaporator status icon leads to the screen we have just discussed. In this manual we will cover screens brought up by two of the other icons: Schedules (the clock icon) and Service (the person with tookbox and wrench) ; the other icons (User-defined screen, Alarms, and Authorization) are covered in the AKC 55 System User Manual.

Schedules

Select the clock icon at the bottom of any screen for a circuit and you will be taken to that circuit's schedules screen. For a Degree Master, the screen looks like this:



The fields and the meaning of their contents is as follows:

Defrosts per day: The number of defrosts per day chosen during configuration.

Start: Start time for the first defrost.

Min: Minimum defrost time in minutes.

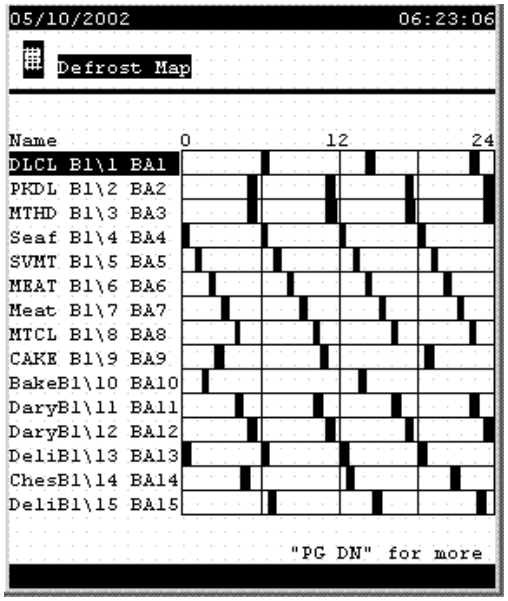
Max: Maximum defrost time in minutes.

Last Def Dur: Duration of the most recently terminated defrost.

Last Def Time: Time that the last defrost was initiated.

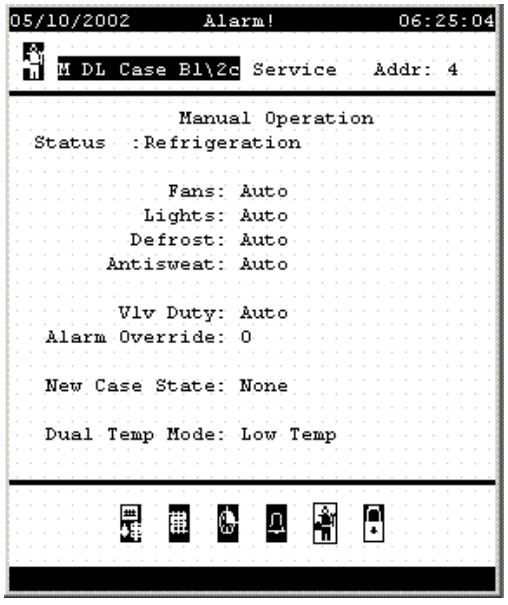
Defrost map

A related screen is the Defrost Map, which is reachable from its icon at the bottom of the evaporator menmu screen (evaporator overview screen) that lists all the circuits in the group. The defrost map shows graphically the defrosts of all the defrosts in the group and when they occur. Here's the screen for the group we've been working with:



Service screen

Selecting the service icon (a person with a tool kit and wrench) brings up the servcie screen.



The fields and the meaning of their contents are as follows:

Status See the list starting on page 17.

Auto, Manual On, and Manual Off

Fans, Lights, Defrost, Antisweat, and Vlv Duty can be set to any of three operational states in this screen. The states are:

Auto The device will operate based on the output of the Degree Master.

Manual On Degree Master control is overridden, and the device will remain On until restored to Auto by an authorized person using this screen.

Manual Off Degree Master control is overridden, and the device will remain Off until restored to Auto by an authorized person using this screen.

Other fields on the screen are these:

Alarm Override: Alarms from the case can be overridden for a user-specified length of time by entering a number of minutes in this field. No alarms will be generated until the time expires.

Dual Temp Mode This field is used to toggle the operation of the case between low temperature and medium temperature.

New Case State

The New Case State field is used to put the fixture into certain specific service-oriented override states, or to return it to normal operation. The settings are:

None

Normal Operation The fixture will operate with its normal parameters, subject to any overrides in other screens.

Normal Defrost A defrost will be initiated that will terminate according to the normal rules established in configuration.

Timed Defrost A defrost will be initiated that will terminate when the maximum defrost time has passed.

Case Cleaning All functions will be turned off until restored to operation in this screen. An alarm will be generated after the

case cleaning alarm delay expires before the case is returned to normal operation.

Case Off

All case functions will be turned off, and will remain off until restored to operation in this service screen.

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